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Pineapple pattern, Robinson, Oahu.

By V. W. Thalmann

THE LARGEST soil conservation program ever undertaken by private industry is in Hawaii. Pineapple growing is the second largest agricultural industry in the Islands, ranking next to sugar. It was not carried on extensively until after 1900. But by 1939, according to estimates by the Soil Conservation Service, 68 percent of the pineapple lands had lost from one-fourth to three-fourths of the topsoil, and 22 percent erosion had taken away from three-fourths to all of the topsoil. In little more than a quarter of a century erosion had damaged all but about 10 percent of the pineapple lands.

THE pineapple people were gravely concerned. The largest of the companies had tried several methods of field drainage but still, when the torrential "kona" rains came, acres upon acres of the young fields, which had been so laboriously planted and carefully tended, were washed out or covered up with silt. The eroded subsoils that were left were harder to farm, and produced lower yields of poorer quality fruit.

Conditions were especially serious on the Island of Lanai, entirely owned by this company. Approximately 15,000 acres had been planted to pineapples, always in straight rows over hill and down dale. Across the plant rows at 300-foot intervals were the harvesting roads, over 400 miles of them, also in straight lines. No matter where rainwater fell and wanted to run downhill, there was a man-made water course, either a clean-tilled cultivator space between the rows, or a road to help it speed on its way and take the soil with it. After heavy rains the blue ocean waters around the island were stained red with soil for miles out.

The most successful of the earlier attempts to prevent this loss was in 1937 when the Lanai field superintendent experimented with contouring a steep field that was scheduled for planting that

NOTE.—The author is soil conservationist, Hawaiian Pineapple Company, Ltd., Honolulu.

Straight up the slope, and down. The soil left hurriedly and in vast quantities under the battering of a 6.35-inch, 3-day rain.

year. From mainland magazines he had seen how contours had been used in corn and cotton planting, and he decided to set out the rows of plants in contour over the irregular slopes.

Before the plants had time to take root, a torrential rain fell and while it created some damage, the latter was far less than usual, much less than in adjoining fields planted in straight lines.

Pineapples were a new crop to the men who came to form the staff of the Soil Conservation Service at the Honolulu office. But topsoil riding downhill in running water, or over the horizon with the wind, was an old story to them.

The Hawaiian Pineapple Company set aside 60 acres of the 1939 planting on its Oahu plantation as a cooperative experiment. Two other firms, Libby, McNeill & Libby and the California Packing Corporation, contributed other lands. The Soil Conservation Service men were to plan the erosion control measures, and the plantation men were to adopt their methods to the new pattern.

It was decided that contour planting, proved partially successful on Lanai, would not be enough. The miniature dams formed by the rows of plants across the slope were able to hold the rainwater perfectly during moderate rains, but the rains were not always moderate and during the "kona" storms the dams sometimes failed. Terraces—continuous mounds of earth—were built at frequent intervals across the slope, not quite on the exact contour, but with a very slight fall toward one end.

The water which escaped through the contoured rows of plants was to be impounded above the terrace ridges before it could build up to destructive speed, and then allowed to run out along the terraces slowly—so slowly that it could not carry the soil with it. Down the slope, drainage channels were excavated into which the terrace water could be discharged safely. Some sort of protective lining was needed to prevent the sides from being gouged, and the Soil Conservation men from Southern States found an old friend ready at hand to help Bermuda grass. The Hawaiians called it "manienie." Plantation men had worked long and hard to banish it from their fields, and shook their heads at inviting it back—but they planted it, nevertheless. Soon a tough, thick sod guarded the outlets channels against the danger of gullying.

That year it didn't rain very hard. No one was sure whether what they had done was enough, or too much. At any rate, the Hawaiian Pineapple Company decided to put an entire field of 455 acres into a cooperative experiment with the Serv-

Around the hill, for safety's sake. Terracing and contour planting. Same time, same area, as scenes on opposite page.

ice in 1940, while additional fields on the Island of Molokai were contributed by the California Packing Corporation.

After the terraces were completed on the Lanai field and it was half planted, in its most vulnerable condition with soil loosened and pulverized and the young plants not rooted in the ground, the first hard rain came. Nearly seven inches fell in a few hours. Water was everywhere, trickling down the slopes between the terraces, backing up behind the ridges to within a few inches of their tops and flowing slowly along them out of the field. It was clear water, and it was walking, not running.

By that time the Soil Conservation Service men were heavily engaged in making plans for other pineapple companies, for the vegetable growers, and in mapping soils and erosion conditions on all the island, but they agreed to plan around 1,200 acres for the Hawaiian Pineapple Company in 1941. Meanwhile, the management of the company had been doing a little calculating. At any rate, many years would elapse before the thousands of acres on its plantation would be protected. During that time, the valuable pineapple lands might be damaged irreparably by erosion.

When a company proposed that the Service take over the planning for as much as 3,000 or 4,000 acres a year, someone suggested that the company employ a trained man to build up its own soil conservation program.

That was in May 1941. U. S. Allison, who had worked closely with the company, knew a chap in Texas who might be willing to come to the islands. This chap had spent 8 years fighting erosion through the South and Southwest and in Puerto Rico, and he was invited to join the company. That was how the writer of this article happened to go to Hawaii.

In the late fall of that year, prospects were bright for a big year's job of erosion control in the spring of 1942. The survey crews had been built up to the point where they could do the precise, painstaking surveys, and stake out 4,000 or more acres. Tractor and grader operators had learned how to keep the dirt rolling fastest along the blades of their new machines. Answers were being found to the vexatious problem of following the curved rows with the plantation equipment.

Then the Japs struck at Pearl Harbor, and erosion had to be forgotten for a while in the face of a more immediate menace. The plantations went to war, and weeds grew over the fields. By the summer of 1942, the pineapple plants were visible again in the weed-grown fields, and the crop was harvested with half a crew. One advance made that year was in learning how to harvest fruit on roads parallel to the plant rows, so that the roads could curve around the contour, too.

Wrapping up the remaining good land in graceful loops. A contour lay-out on a ridge field. The ridge in the right foreground was formerly in pineapples—now it's beyond bothering with.

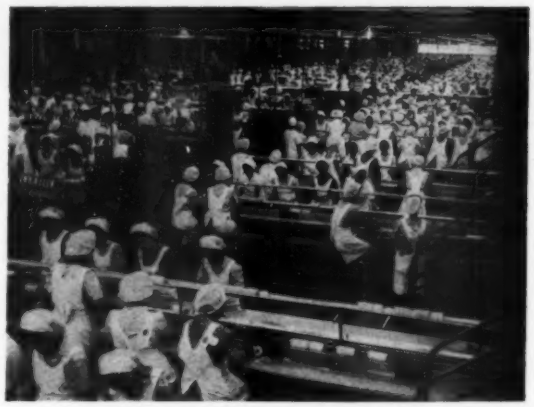
That year, 2,700 acres were wrapped around the hills on contour and tied down with terraces.

On January 3, 1943, the rains started on Lanai, and in a few days some 15 inches fell. Nearly 11 inches fell in 1 day on one of the newly terraced fields. Water streamed over the cliffs but it wasn't "soupy—too thick to drink and too thin to plow." There were no washed-out plants, no raw, red scars of gullied land.

During that year the terraces were built broader and with gentler slopes, so that the equipment could ride the ridges better, and the roads were put in the channels above the terrace ridges. Over 3,000 acres were terraced and contour-planted on Lanai, and 2,500 on Oahu.

In 1944 over 6,000 acres were terraced and contour-planted, and the work went on at full blast in 1945. On completion of this year's operations (1946) we will have constructed 1,343 miles of terraces, 25.3 miles of diversion channels, and 74.9 miles of terrace outlet channels on 24,721 acres of pineapple lands.

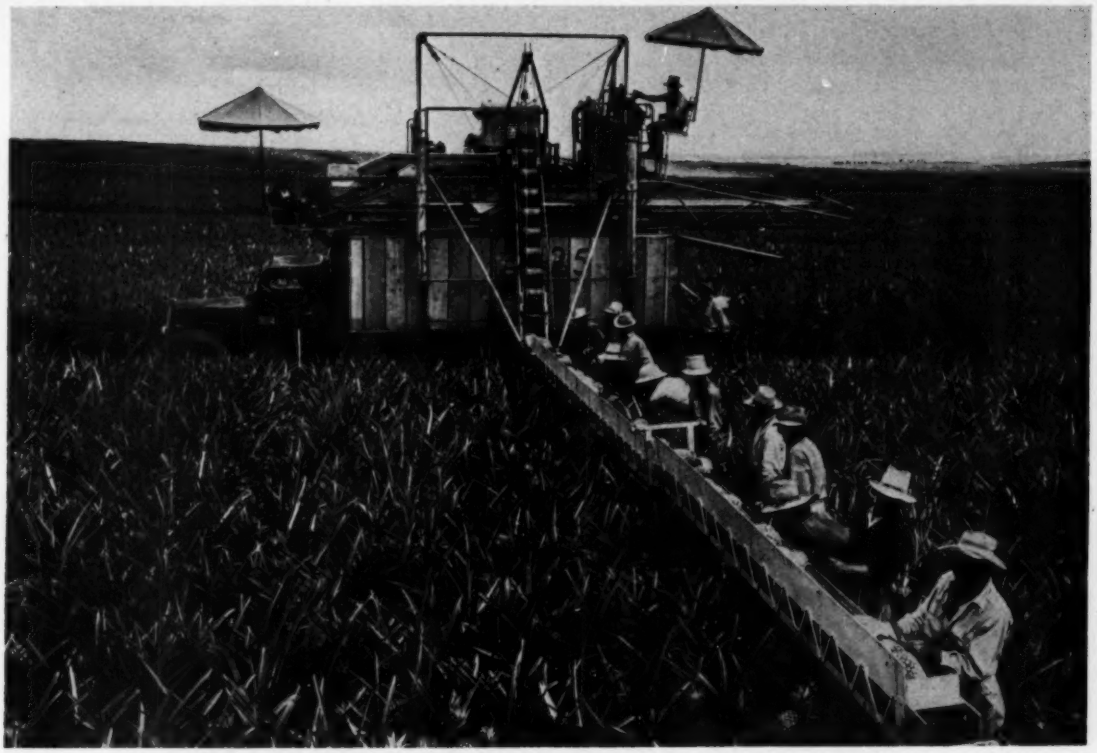
All of the terraced acreage and a few additional fields, with the exception of limited areas of very gentle slope and some of the field borders for mealybug control, are planted on the approximate



Trimming, slicing, and packing.

contour. With the completion of the 1947 planting, we expect to have nearly all of the 27,500 acres of our pineapple plantations on the contour.

This brief summary of the development of soil conservation in Hawaii, particularly as directed by the one company, barely alludes to the many problems peculiar to this operation. Numerous modifications in accepted mainland terrace design, lay-out, and construction practices have been necessary in order to adapt terracing to our usual



Assembly-line harvesting fits right into the modern scheme of agriculture in Hawaii.

operating methods and equipment. To the tractor drivers and field workers accustomed to seeing the well-ordered plant rows stretching away over the horizon in perfectly straight lines, the first contour-planted field looked like a horrible nightmare.

To avoid undue complication of field lay-out, and excessive loss of producing area in roadways, it has been necessary to design terrace spacings, insofar as possible, in multiples of road intervals. Present-day equipment requires roads at a maximum spacing of 115 feet. Although intervals have been far in excess of mainland standards erosion has been slight even in the heaviest rains.

Channel cross-section of the terraces is considerably larger than usual on the mainland, ranging from about 9 to over 20 square feet standard effective section, depending on the slope. This enables us to use rather long runs without excessive grades and velocities. Runs generally are limited to about 1,800 to 2,000 feet in one direction of flow, but occasional runs of 3,000 to 3,600 feet on gentle slopes have operated with apparent satisfaction. A "standard" terrace would be graded 0.2 percent for 800 feet, 0.3 percent for 700 feet and 0.4 percent for 500 feet toward the outlet. On long terraces, 0.1 percent grade sections are included at the upper end, and the lengths of other sections increased if necessary. Additional capacity is obtained by increasing the cross-section along the entire length of the terrace.

To fit the terrace systems into our intensive production operations to best advantage, all plans are worked out on fairly accurate topographic maps prior to field lay-out. Each case is worked out on its own merits both on paper and in the field.

Terrace construction is expensive in comparison with mainland costs. However, it is a very small proportion of total field operating cost. Figures on three representative fields recently completed, totalling 1,253 acres, were $5.15 per acre for survey, lay-out and checking, $3.83 for rock removal, $159.21 per mile for terrace construction, $572.07 per mile or $0.05 per cubic yard

(*Continued on page 206*)

How a FARM is PLANNED

Looking at plans and specifications: Anis Rivers, farmer; Ted Calvert, technician.

By William R. Elder

LAND in Northeast Texas is generally sandy surfaced, gently to steeply rolling; and originally it was covered with mixed hardwood and pine forests.

Soils are variable, some being deep sands. Some have sandy clay subsoils, others heavy clay subsoils. Except where erosion has exposed the subsoil, surface soils all look much alike. All the soils are of the Forested Coastal Plains. Annual rainfall is about 40 inches, most of which falls in winter months. Erosion has been severe, particularly on slopes over 3 percent, due to continuous cotton growing, few terraces, no winter cover and naturally erosive soils. Slopes are extremely variable, ranging from 0 to 30 percent, with frequent sharp breaks from one extreme to the other.

Farms in this area average about 90 acres, and range from the large livestock farm to the small, intensively cultivated truck farm. A few large cotton farms are left, but due to low yields, erosion and labor shortages, the trend has been away from cotton.

A soil conservationist considers many factors in making recommendations for the safe use of East Texas soils. Some, such as slope and erosion, he determines by observation as he walks over a farm. Others, such as depth, texture, drainage condition and permeability of the soil, are not so readily apparent, and he must get his information from samples and tests. A soil conservation survey of each farm, made by a soil scientist, furnishes the needed information on hidden characteristics.

THE Anis Rivers farm, located in the eastern part of the Sulphur-Cypress Soil Conservation District, is typical of the smaller, more intensively cultivated truck farms. Rivers moved to the 67-acre farm in 1930 and has been farming it since that time. The land was cleared and put into cultivation in 1904, cotton and corn being the main crops. Erosion has not been too severe on the farm as a whole, due to moderate slopes and to terraces which were put on the cultivated land in 1940. Before the conservation plan was made, Rivers operated this farm with 40 acres in cultivation, 16 acres in pasture and 11 acres in woodland. Faced with declining yields, cropland depletion and inadequate pastures, Rivers attended a meeting with his neighbors in the community church to discuss means of checking erosion and restoring the agricultural prosperity of the community.

At this meeting Soil Conservation Service personnel explained how a soil conservation district provides technical assistance in planning farms, based on the capabilities of the land, the treatment needed by the land, and the needs and desires of the farmer. Having observed the improving crops and pastures, the decreased erosion and the growing prosperity of farms cooperating with the soil conservation district, Rivers made application to the district's board of supervisors for assistance. His application was approved with those of the South Omaha Soil Conservation Group.

A conservation survey having been completed by a soil scientist for each farm in the group, Ted Calvert, a soil conservationist assigned to the district, prepared to help Rivers work out a conserva-

NOTE.—The author is soil scientist, Soil Conservation Service, Mt. Pleasant, Tex.

tion plan for his farm. As part of his preparation, Calvert studied the conservation survey, putting in the capability class numerals and determining the approximate acreage in each land use.

By studying the basic inventory of the soil resources of the farm, Calvert was able to evaluate its physical needs and possibilities. He found that Rivers had a choice between continued emphasis on row crops or a change to livestock.

After discussing with the farmer the present cropping system, and the number and kind of livestock, Calvert suggested that they walk over the farm together, taking with them the plain photograph and conservation survey.

"Do you intend to keep about the same acreage in cultivation or would you like to plan on more pasture and more livestock?" Calvert asked.

"I want to keep as much of the cultivated land as I can," replied the other.

This determined the basic plan. Calvert's study of the conservation survey had already indicated that every acre on the farm was adapted to either pasture or meadow, but not all of the land could safely be cultivated.

River outlined his problems as they walked: "My terracing system is not working as it should. Also, part of one of my fields is badly washed and I think it should be taken out of cultivation. The timber is all slow-growing post oak, and I need more pasture. Perhaps some of the woods should be cleared."

Calvert from his previous study of the conservation survey, had concluded that the principal objective of a proper plan on this farm would be to retain approximately the present cultivated acreage, maintain adequate erosion control, maintain or increase soil productivity by use of cover crops and rotations, and develop a pasture and meadow plan which would produce the highest possible amount of forage. The number of livestock kept on the farm could then be adjusted to the feed supply.

Starting in Field 3, a 6-acre cultivated field which is partly Class II and partly Class III land, the two men discussed the terraces, and agreed upon the conservation crop rotation, including the cover and soil improving crops. Referring to the conservation survey, Calvert found the soils well adapted to growing the crops Rivers wanted. A crop adaption table, based on the pooled experience of all Soil Conservation Service personnel and farmers in the area and showing crops, legumes and grasses adapted to each soil, was used. This table is of considerable value to Calvert in his planning work, particularly in cases such as this, where truck crops are grown. Soil characteristics have an important influence on truck crops where heavy fertilization is necessary.

The farmer and the technician walked on to the farm pond. This pond had been constructed for some time, was adequate in size and had a good spillway. It was not seeping, since it was constructed on a soil having a dense clay subsoil. They discussed the possibilities of the pond for both stock water and fish production, and planned the stocking rates and management practices.

Moving on, they came to a cultivated field (No. 7), and Rivers said: "Here is one of those spots where I haven't been able to hold the soil, and I don't grow much here. Maybe I need to do something else with this." This area was one of the critical spots found by Calvert in his study of the conservation survey. His tentative treatment before seeing the farm was either to put it in sericea lespedeza meadow, as the soil was well adapted to that crop, or to put it in pines. Since Rivers realized its limitations as cultivated land, and the conservation survey showed it to be in Capability Class IV, Calvert said: "I believe you could grow some fine sericea lespedeza here for your cows, control erosion and improve your soil all at the same time." Mr. Rivers nodded his agreement. A 2-acre meadow was planned which will yield 2 tons per acre of a hay equal in quality to alfalfa, yet grown on soil incapable of producing alfalfa.

Passing to the next field, partly woodland and partly pasture, the owner explained: "I have thought of clearing this timber off and making pasture out of it, but it will supply enough posts to do the fencing I have to do, so I haven't been in a hurry." Glancing at the conservation survey, Calvert found the woods to be growing on two kinds of soil: Class II land and Class V land, both well suited for pasture development. Replying to Rivers the technician suggested: "I believe you could clear all of the timber off of this area except the trees that will make posts—those you can cut later as you need them; that way you can go ahead and overseed with clovers and lespedeza and develop your pasture now." (This cleared area together with the adjoining land already in pasture now provides 22 acres of high quality pasture, and supplies the bulk of the grazing for the livestock kept on the place.)

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The two men returned to the cultivated land in Field 8, where the terraces which were not functioning properly were inspected and marked for a complete engineering check-up later. The rotation was worked out and checked against the crop adaptation chart for the suitability of the soil for the crops chosen.

Proceeding to Field 9, a 4-acre timbered slope of Class VI land, Calvert recognized another critical spot, which he had already marked for treatment. Since this timber was slow growing, small post oak not suitable even for posts, the use being made of this area was not economical. "This isn't worth much as it is," Calvert observed. "It's too steep for cultivation, but the soil is still fertile and fairly deep. Planted in kudzu, you could hold and improve the fertility of the soil on this slope and at the same time have a fine temporary pasture and meadow crop that would help out a lot with the grazing during the heat of the summer when your other pastures are poorest." After some discussion as to the number of crowns needed, method of planting and care of the stand, Rivers decided to clear the worthless timber and plant 4 acres of kudzu.

As they crossed a neck of Field 2, a small bottomland already in pasture, the farmer and Calvert discussed the overseeding of white dutch clover, since this area is particularly suited to it from both a soil and moisture standpoint. It was agreed that the overseeding would be done.

Moving into Field 5 as shown on the map, Rivers said: "Now this land used to make good crops, but washed too much before I got it terraced, so now I don't make anything to speak of here." This was the third critical area observed by Calvert in his preliminary study.

"You could build this up and either cultivate it again or make pasture out of it, but it would be a long, slow process," Calvert explained. "The quickest way to get this in production again would be to put it in sericea lespedeza. With phosphate and proper seeding you can tie the land down and make a good hay crop at the same time." Moving around the slope, they came to a seepy spot which was not cultivated. Nodding at it, Rivers remarked: "That spot is good after it dries out but I never can plant it at the time I plant the rest of my crops, as it is too wet then."

Calvert pointed out: "You could plant kobe lespedeza and tie it in with the sericea meadow so that both could be cut at the same time."

There remained only Field 4, a 10-acre cultivated field. As they crossed it, they discussed rotations, cover and soil-improving crops, and particularly the adaptation of the crops to the soil. The terraces and outlets came in for consideration and were marked for further checking.

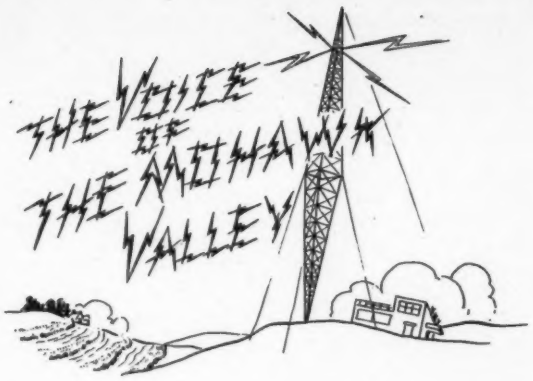
From the notes Calvert made, which he later used in writing up the plan, he found that Rivers had 32 acres of cultivated land which he could safely leave in cultivation. Eight acres he had been cultivating would go into pasture and meadow. Of the original 11 acres of poor timber, 7 would go to pasture and 4 to kudzu. All post trees were to be saved until needed. On the 26 acres of pasture and 7 acres of meadow Rivers could carry 8 head of cattle safely without buying feed.

A sound conservation farming plan resulted from all this: (1) erosion had been controlled; (2) adequate conservation crop rotations had been set up, with enough cover and soil-improving crops; (3) pastures and meadows had been planned to provide the maximum feed supply; (4) proper land use had been attained in all fields; and (5) the plan fitted the operator's needs, desires and equipment.

This plan was developed quickly, accurately and with a minimum of discussion primarily because of two things: First, the operator is a progressive open-minded farmer eager to improve his farm, second, the technician, because of his study of the basic inventory of the soil resources, knew the farm's c a p a b i l i t i e s. Together, they arrived quickly at a sound plan with every crop and practice on land suited to its production and protection. As a result, Rivers looks forward to a constantly improving farm, with better crops and better livestock, secure in the knowledge that his farm is here to stay.

DISTRICT NAMED FOR PERSON

Massachusetts has the first soil conservation district in the Northeast—perhaps in the Nation—to be named after a person. The Richard T. Fisher Soil Conservation District is the new designation for what was formerly the Northwestern Worcester County District. The board of supervisors chose the new name in honor of the professor who attained world-wide fame as director of the Harvard Forest, which is in Worcester County and which became a unique forestry institution under his guidance.



In the farmland around Utica, N. Y., radio station WIBX is making a consistent effort to encourage better soil practices.

To help other radio stations which may be interested in doing something similar, here is a partial report:

Regular, systematic contact is made with the soil conservation district offices in the WIBX coverage area. Each morning, quite early, before the technicians have gone out into the field, Tom Page, WIBX farm director, contacts them, and talks over the things they are doing.

This occupies some little time for him and for the various SCS men. However, WIBX and the soil conservation districts in the Mohawk Valley of Upstate New York have found that the time is well-invested.

One of the big problems faced by SCS districts has been that of getting to larger numbers of farmers, with a clearer picture of what the work is really all about.

By clarifying his own information in direct talks with the field men, Page is better able to pass the word along.

Because WIBX serves a dominantly dairy region, several programs have been built around pasture improvement.

Pasture improvement is usually done with a bulldozer, which clears thornbrush and often old hedgerows. Swampy places are drained. The land is levelled if that is necessary, although it is usually not a major problem. Then, to kill roots of trees and brush which may survive the clearing with the bulldozer, the land is plowed and cropped for a year.

It is then fertilized, fall plowed, manured during the winter; it is top-dressed with lime if the pH is too low or with superphosphate if it is too high.

Seeding is done with an approved mixture, determined for the region after on-the-job experiments by the State College of Agriculture.

Naturally, the soil conservation effort takes in other phases of work. This one has been chosen as an example.

WIBX has assigned a quarter hour each Thursday morning to soil conservation work exclusively. Other broadcasts throughout the week, (WIBX carries a minimum of 13 farm service broadcasts each week), may also give considerable time to notes of importance.

Reports from technicians in the field are compiled, with brief explanatory notes, and are broadcast. In this way, farmers hear of the activities of their neighbors. It is felt that farm people may be given ideas in this way which they might not get so soon without the broadcast. Farms are cited for their experience with farm ponds, drainage and diversion ditches, contour and strip cropping, cover cropping, and many other practices.

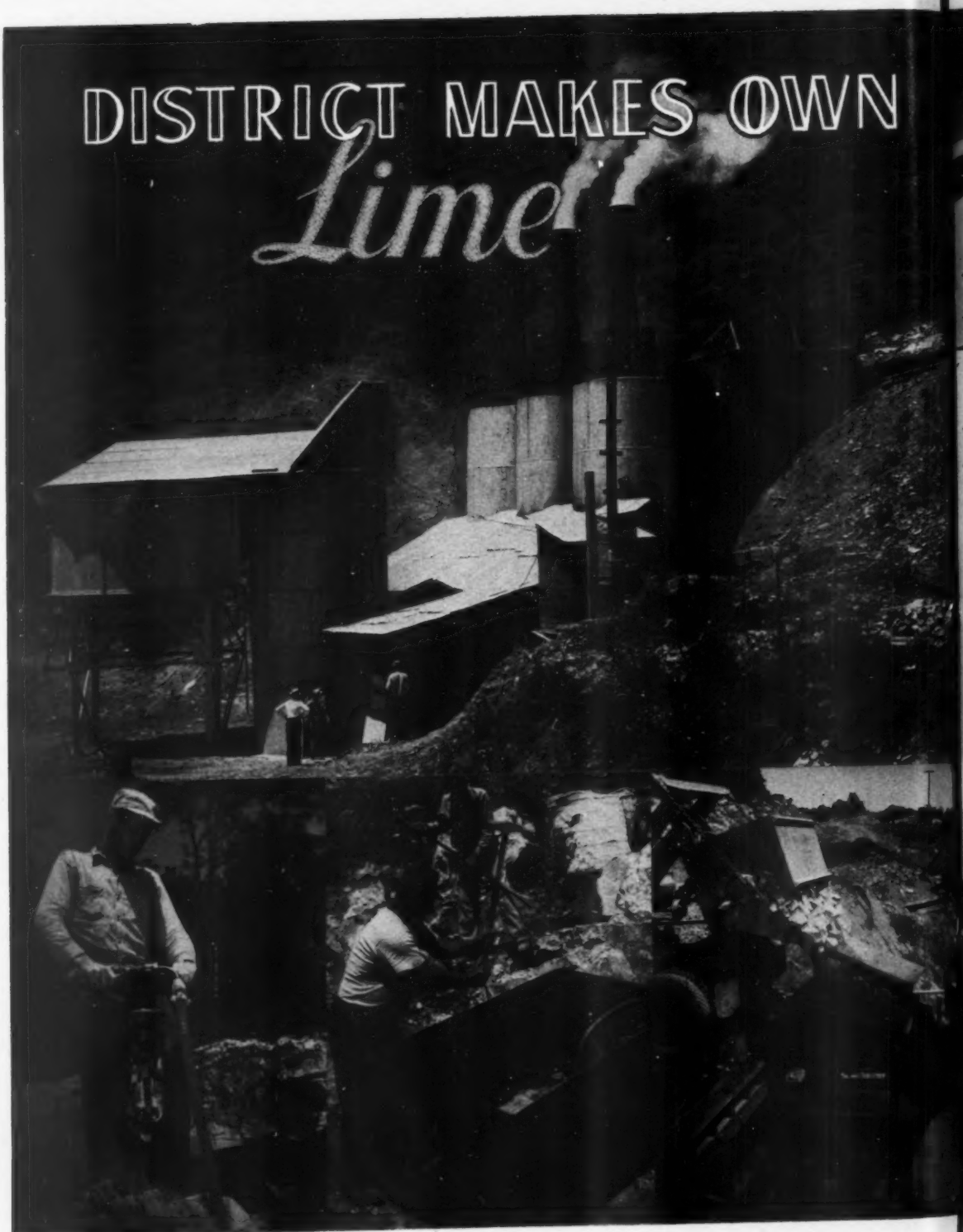
From time to time, soil conservation people appear on the broadcasts. In most instances they appear without scripts, but with informative notes. The discussion has an easy, informal quality.

The WIBX special-events truck and an engineer are sent with Page into the field.

Recently, for example, they drove into the country several miles from the highway, where the Oneida County Soil Conservation Service was using dynamite to construct a ditch through swampland on the Albert Maier farm, R. F. D. 1, Clinton, N. Y. For most of an hour, Tom Page, in working clothes, and up to his boot-tops in icy water, assisted and asked questions. Technicians Lynn Abbott, F. E. Mulvaney, and Stanley Greene, and Maier and his son Albert, Jr., were at work. When the 250-pound charge of dynamite was planted, they went up to a spot near the WIBX special-events truck. A 750-watt, 60-cycle, 110-volt generator in the truck, provided electricity to operate the GE wire recorder.

The entire project was described for the broadcast. Everyone made his contribution. Finally, the "hot-stick" was placed. That is, the end stick of dynamite with the electric cap in it was connected. At a signal from Page, Abbott, a licensed

(Continued on page 215)


DISTRICT MAKES OWN
Lime

Pictures and text

By Hermann Postlethwaite

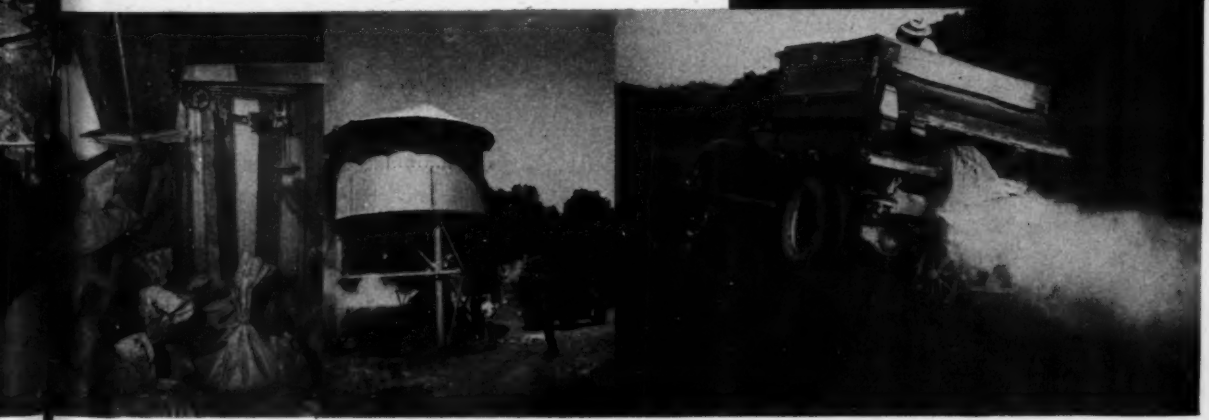
DISTRICT supervisors of the West Fork Soil Conservation District, Clarksburg, W. Va., are mighty proud of their new lime plant on historic Rich Mountain, in Randolph County.

Modern in every way, this plant was built at a cost of $30,000 by the State Soil Conservation Commission, which used part of the revolving fund of $100,000 appropriated by the legislature for development of agriculture within the State. It has been turned over to the district supervisors for operation.

The three tall brick-lined steel kilns are capable of producing 50 tons of ground burned lime a day. At $8 a ton for bulk lime and $10 a ton for sacked, this is about $4 less than the prevailing local prices. When full production is reached, it is hoped the price can be cut to $5 a ton for bulk lime.

(*Continued on next page*)

NOTE.—Mr. Postlethwaite is photo editor, Soil Conservation Service, Washington, D. C. He was formerly conservation aide, Clarksburg, W. Va.



Dairy herd of Otis Lawther on pasture improved by Rich Mountain lime; 18 acres support 18 animal units. Pasture has been clipped for weed control.

Strip cropping on farm of F. D. Bartlett, Lost Creek, W. Va. Every acre of farm, cultivated and pasture, has been limed—and shows it.

Efficiency is the keynote. A compressed air-drill takes the place of the old back-breaking, hammer-pounded hand-drill, and dynamite loosens great quantities of the native limestone with the twist of a wrist at the battery box.

Four to six inches of fine coal is put into the dump buckets. The latter are picked up by a truck and moved over to the face of the quarry, where they are filled by hand with knapped stone. This is the only hand operation from native stone to agricultural lime.

The hydraulic hoist, mounted on a low truck chassis, lifts the full bucket and maneuvers it into position over the hopper. This hopper is mounted on rail tracks and can be moved into position for filling the kiln. The dumping mechanism releases the bottom from the bucket, letting the mixture of stone and coal flow into the kiln.

The burning operation goes on continuously. Coal and new stone keeps feeding the fire and the burned stone is drawn from the bottom onto conveyor belts which carry it to the crusher.

Instead of hauling stone to the fields and waiting weeks for nature to do the slacking, the crusher does it in a few minutes. The powder-fine lime is deposited in two storage bins by bucket elevator and conveyor belt. One bin is for bulk delivery and the other for packaging, together they have a capacity of over 250 tons.

All conveyor belts and the crusher are electrically operated from current supplied by a rural electric line.

At present farmers must come and get the lime. Eventually, the supervisors expect to own trucks with spreaders attached. They will then haul the lime and, for a small additional fee, spread it on the land for the purchaser.

Soil Conservation Service technicians estimate that more than a million tons of lime will be needed as an initial application on the 7,400 farms in the 4-county district. Thereafter, 50,000 tons should be applied each year for continued maximum production. The sale of lime is not restricted to one district. After district cooperators are supplied, anyone within the State may buy from them.

The Rich Mountain plant is but the first of several which the State Soil Conservation Commission plans to build in West Virginia.

The West Fork Soil Conservation District supervisors—A. E. Rogers, Bernard Linger, G. Manley Curry, Paul Nutter, and Ross Leatherman—estimate that there are several million tons of stone available in the deposit they have leased.

PINEAPPLES ON THE CONTOUR

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for outlet-channel excavation, $415.25 per mile for outlet grassing, and a total of $22.61 per acre for the completed job.

Cost of our completed terracing program, including revisions to be made on some of the earlier jobs to bring them up to present standards, is estimated at about $500,000. Flood control work in the Palawai Basin, Lanai, including settling and detention reservoirs, channels and disposal sumps, will cost an additional $100,000.

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LAND USE *and* Conservation

By Chester C. Davis

President, Federal Reserve Bank of St. Louis, Mo.

IT HAS been estimated roughly that man has existed for only about a quarter of 1 percent of the age of the planet earth. The last few years—perhaps 10,000—since man began to plant seeds and harvest the crops, probably amount to only one-fifth of 1 percent of the age of man. Yet in that short time comparatively great civilizations have grown, flowered, and have perished because man destroyed the soil in which they were rooted; desert sands now blow over the marble ruins of once great cities.

It was only a little over 300 years ago that white man's plow first pierced the soil of America—a span which compares with the earth's antiquity as the tick of a clock with eternity. Yet the loss of the land, the waste and impoverishment of our soil in that span of years has been incalcuable, and is still going on. Estimates of the Soil Conservation Service, frequently quoted, say that since colonization began in what is now the United States, at least 50 million acres of once good land have been ruined by soil erosion; it has been abandoned and can no longer be farmed. Another 50 million acres are swiftly coming to the stage where it is unfit for farming. One hundred million acres of once good land gone! On another one hundred million acres, more than half the topsoil is gone and on a third one hundred million acres, erosion processes are actively under way. These are not new figures but they tell the story of improper land use, of the failure of the American people to care for the land. They sound a warning; they highlight the importance of proper soil management and land use on every farm in the United States.

LET me sketch in just another bit of background the moral or ethical aspect of soil conservation and improvement. If this nation is to hold the basis for its future greatness, each generation must preserve and enhance the soil resources for the use of generations to come. Up to now each generation has defaulted in this responsibility. The English Government is now proposing that a farmer's right to hold and operate a piece of land be made conditional; that if he fails to operate the land as decreed by the State the land may be taken from him. We recoil from that suggestion here. We prefer to tackle the problem through education, demonstration, leadership, and financial inducements or subsidies. But make no mistake about it, that problem stares us in the face and we haven't licked it yet in spite of some progress made. The day is gone, if it ever existed, when the fact that an individual holds a deed to a piece of land gives him the moral right to destroy it through stupid, short-sighted farming practices.

For a century, successive wars have hastened the process of waste and destruction of our land and our natural resources in spite of our feeble efforts at organized conservation. Our conservation balance sheet continues to show more losses than gains, notwithstanding the progress made in recent years in enlightenment, in acreage organized in soil conservation districts, in the application of approved practices, and in the return of life-giving minerals and organic matter to the soil.

Look at what we are doing compared with what needs to be done. The Agricultural Adjustment

NOTE.—This article is taken from a somewhat more extended address delivered at the Graduate School Seminar, Department of Agriculture, Washington, D. C., on January 16, 1947.

Chester C. Davis, statesman of finance.

Agency's 1945 report presented an estimate of actual conservation needs. . . .

According to this estimate, the farms of the United States need currently to have applied to them 60 million tons of ground limestone and 13,200,000 tons of 20 percent superphosphate annually. What has the record been? 23,830,000 tons of limestone and 1,950,000 tons of superphosphate spread by participating farmers in 1944; 21,338,000 tons of lime and 2,400,000 tons of superphosphate spread in 1945. This marks a tremendous gain in recent years, but it is still far short of what is required for the economic and the physical health of the nation. . . .

THERE is no use of going into general figures as to need and performance in the case of other conservation practices. . . . No matter what we have done, our performance has been small in comparison with what we need to do. And I am about finished with generalizations, with total national estimates and reports, and ready to get down to cases in the balance sheet of conservation farming or balanced farming or whatever you want to call it.

First let me say that *when we organize conservation districts, or hold meetings or publish bulletins we are only helping build the frame for the conservation picture. The painting in of the picture itself is done by actual, concrete performance on the individual farm.* I want to drive home this point: *the pay-off comes in the adoption for an individual farm of a complete, integrated, balanced program of soil and water and crop and livestock management. The program to be fully successful must be complete.*[1] The mechanical engineering steps of terracing, contour cultivation and grassed waterways are not enough. Minerals need to be restored, soil health brought back with organic matter, with crop and livestock systems fitted to the land. It may take 5 years, or 8 to 10 to complete such a program on a farm, but the starting point must be a plan that sets our definite steps to be taken each year. When the plan is set, then it is up to the operator to stay with the job until it is done.

Proper land use on the individual farm is simply a matter of fitting the cropping system to the natural capabilities of the soil.[2] Then, after determining the crops best adapted to the land, working out an erosion control and soil-building pro-

gram which will give maximum output at minimum cost while maintaining or increasing the productivity of the soil.

Not until that kind of performance is under way on every farm in the country can we rest assured that this Nation has met its over-all responsibility for the care of the land. Furthermore—and it has taken a long time for me to build up to the point where I talk like a banker—every dollar of new capital that goes into carrying out such a soundly conceived farm plan will repay the investor or lender in short order through increased yields and lower production costs. The farmer or land owner or mortgage lender will have a better farm 5 to 10 or 20 years from now than he has today to operate or to secure his loan, an assurance altogether lacking in American agriculture as a whole right up to now.

LET me throw a few figures at you with which many of you are familiar. The Soil Conservation Service completed a survey early in 1946 covering nearly 10,000 farms in all parts of the United States—farms on which comprehensive programs of soil, crop, and water management had been adopted. These farms showed an average increase in the per acre yield of major crops amounting to 36 percent over the average yields obtained before the programs were undertaken.

I could give you from the records thousands of illustrations ranging from single cases to sizable surveys like the foregoing, to show that farmers who do the best job of maintaining their soils make the best incomes. It will save time if you will accept that as true, and will permit me to get on with the story of some things we have been doing out in the Eighth Federal Reserve district which will, I hope, bring the problem down to dimension where we can grasp it.

Realizing that bankers have great direct and indirect power to promote the adoption of sound land use plans on the farms of their communities, the Federal Reserve Bank of St. Louis started out a little over a year ago to take the story out to them. In cooperation with the land grant college and the State bankers' association in each State, we have held a series of 27 dinner meetings in western Kentucky, northern Mississippi, Arkansas, west Tennessee, and southern Illinois, to which we invited the bankers, asking them in turn to bring along leading farmers, many of whom were directors of the banks. We also invited the Soil Conservation Service technicians and district supervisors, the county agents, vocational agricultural teachers, and P. M. A. committeemen. The Soil Conservation Service supported the program in every way.

WE HAD about 3,000 guests at these dinners, and the interest and attention were nearly perfect. About 4 out of 5 of the banks of the areas visited were represented, which we thought was good, considering that in many cases men had to drive 50, even 100 miles, from their homes to the towns where the meetings were held. The meetings all followed the same pattern. A representative of the agricultural college, using colored slides with pictures taken in the neighborhood, showed the right way and the wrong way to handle the land, and showed clearly how well good practices had paid off right in that county or in adjacent communities where conditions were similar. The agricultural economist of our bank then followed, and presented the records of a single farm case selected as typical of that area—a farm where such a plan as I have been talking about had been adopted and carried out, and where before-and-after records were available. His charts showed from the records the year-by-year investment as the program was carried out, and the actual increase in yields per acre and per farm in crops and in pasture carrying capacity year by year as the improvements took effect. He then outlined a plan by which such a long-range improvement program could be financed by a bank or other lending agency, with amortization repayment based on applying to the loan only a part—usually 50 to 60

[1] The italics are the Editor's.

[2] All soil and water conservationists, will, in the opinion of the Editor, be pleased with banker Davis' definition of soil and water conservation. This definition conforms with the basic guiding principle adopted in the beginning by the Soil Conservation Service and held to at all times, both as a guiding principle and as a hard and fast operational policy. Note the definition by the Chief of the Service (in our American Land, Miscellaneous Publication No. 596, U. S. Department of Agriculture, Soil Conservation Service):

"Soil conservation is proper use and care of the land. It means using the land to produce the greatest amounts of the things most needed, and at the same time protecting it so it will not lose its productiveness. The conservation measures used are being constantly improved by careful research at soil conservation experiment stations throughout the country. All land is not alike. Each field or acre must be used for things it is best suited to produce, and protected according to its needs.

"All measures that help keep the land productive are tools of conservation. Terrace, contouring, organic matter, grass, crop rotations, fertilizer, legumes, shrubs, trees, drainage if the land is too wet, and irrigation if it is too dry—all of these are conservation tools. It is conservation whether the practices are used separately or together."

percent—of the value of the increased yield that could reasonably be expected to result from the improved practices.

We were very conservative in the formula we used to convert those increased yields into dollars. Leaning way over backwards, we used the 15-year average Missouri farm prices of 1925–39, which figured 75 cents for corn, 96 cents for wheat, 40 cents for oats, $12.50 for alfalfa, 11 cents for cotton, and $1.50 a month per animal unit for pasture. In the illustrations we presented we did not count conservation payments in as income available to help repay the investment or retire the loan. If we had, the repayment schedule would, of course, have been greatly shortened.

Before and after these two main speakers, I emphasized the existence of an enormous money supply in bank deposits and currency which might be used destructively in bidding up land and equipment prices unduly, or constructively in carrying out complete programs of soil and water management, and in equipment, electrification, homes, and farm buildings which would increase the efficiency and comfort of farming. I put it up to the bankers that it was in part their responsibility to guide the flow of investment into productive channels. Generally, in the towns we visited the bankers and businessmen were keen to get factories, industrial pay rolls, established there. I reminded them that if those farms in their communities that badly need to stop erosion and to rebuild the soil and its fertility would start this very year on complete conservation programs, the added wealth produced would far surpass in dollars and cents any pay roll they could reasonably hope to acquire.

There was a lot more to it than that, but what I have told you gives you the idea. Now I want tc go back and look at some of those farms we used as illustrations.

First, we studied individual farms which had completed soundly planned land use and farm improvement programs and on which good records are available, in an effort to determine what it costs to convert a farm in a given area from an exploitive system of farming to a balanced plan of operation. We found out what the differences were in cash returns from a balanced land use program as against the old wasteful system, and identified the amount of income that could be traced directly to expenditures for soil conservation and soil improvement practices. It has been intensely interesting. . . .

I think the most significant fact in our research to date is that in all analyses of individual farms we have completed we have not found a single instance in which the investments made for soil conservation, soil building, and other farm improvement practices were not highly profitable. I can best illustrate these variations by giving you some dollars and cents figures on the individual farms.

On a 267-acre farm in northwest Missouri, for example, a 10-year program of converting to a sound and balanced land use program cost a total of $9,714. The problem on this particular farm was primarily one of erosion control. The mineral content of the soil is reasonably high but the topography is rolling and the soil erodes badly. While some minerals are needed for maximum crop output, most of the costs of the farm improvement program here went into erosion control practices, such as terraces, grass waterways, concrete outlet structures, and new fences to line up the fields with the lay of the land. Over the 10-year period, the return from the investment was $15,655 at the average prices I referred to. This was enough to liquidate the full cost of the program and leave the farmer an additional 50 percent for his efforts. Based on the same average prices, the annual income from the farm was increased by $1,944 and the maintenance cost of the program, above the ordinary operating costs, runs approximately $300 per year. On this farm it cost $36.38 per acre over the 10-year period to complete the program and out of that amount $33.25 per acre represented permanent improvement to the land.

Contrast this Missouri farm with a 584-acre farm located in the brown loam hill area in Northwest Mississippi on which a complete improvement program was carried out in a 6-year period at a cost of $7,834 and with added returns of $12,527 for those 6 years than can be traced directly to the improvement investment. The cost averaged $13.41 per acre, over half of which went into lime and mineral fertilizer. Permanent improvement to the land was $6.37 per acre.

The general topography of these 2 areas is somewhat similar. The erosion process, however, has gone much further in the Mississippi area and a large proportion of the 584-acre farm was so badly damaged that it was fenced off to go back into timber production. In that area nature is kind and will almost single-handedly take care of re-

forestation if given a chance. Little cost was involved on that score. The improvement expenditures then were primarily on the lower hillsides where pasture was developed and in the valleys where some row cropping can be practiced. On the Missouri farm, on the other hand, the entire farm with the exception of a wooded pasture is capable of row crop production if a proper soil management program is developed to protect the soil from the ravages of erosion.

Another farm located in the Black Belt that extends into central Mississippi offers an additional contrast from the viewpoint of costs and returns from farm improvement. In a 10-year program on a 145-acre farm in the Black Belt, a total of $8,832 is required to install a sound land use and balanced system of farming. This averages a total cash outlay of $60.91 per acre, a high percentage of which goes into the mineral program. Out of the $60.91 per acre, only $17.12 represents permanent improvement to the land. Despite this unusually high investment, however, in the 10-year period $12,430 in new income could be traced to the $8,832 investment. Calculated on the same average price basis, the income from the farm was increased by $1,711 with an annual maintenance cost of $600.

To carry this analysis a little further, let us review some figures from 10 farms scattered throughout the Eighth Federal Reserve district on which we have analyzed the records of farm improvement programs on a before-after and through-the-middle basis. These 10 farms include a total of 2,255 acres of land with an average normal appraised value of $47.64 per acre at the time the improvement programs were started. The time involved in the improvement programs has ranged from 6 to 10 years and for the 10 farms has averaged 8 years. The average improvement cost per acre has been $29.28 which is approximately 61½ percent of the original normal appraised value. However, the average per acre returns during the period in which improvement programs were being completed increased $65.47 which is a $2.20 return for every $1 invested in soil improvement. Of the total of $29.28 invested per acre, $17.58 represented permanent improvement to the land and raised the normal appraised value on the average from $47.64 to $65.22 per acre.

The average farm of those analyzed would be a 225½-acre farm with a normal appraised value of $10,744 at the time the improvement program was started. An addition of new capital in the amount of $6,603 would be required to complete the improvement program in an 8-year period. This investment of new capital would result in increased income in the 8-year period of $14,568, or $2.20 return for each $1 invested. The yearly income from the farm following the completion of the improvement program would be increased by $2,391 with an annual maintenance cost of $568 which would leave a net increase in income of $1,823 per year. The normal value of the farm would have increased to $14,708.

That, I think, pretty well gives the story for the individual farm, and while I have long been convinced of the moral responsibility we have towards sound land use, these studies and a pile of other evidence prove to me that, morals or ethics aside, from a cold business standpoint, the man who controls a farm cannot afford *not* to start now on a complete and integrated program of conservation farming.

One more word about capital. A conservation program, generally adopted, would require a lot of it. There was a time when the lack of capital would have been definitely a limiting factor. In isolated instances that may even be true today. It has been interesting to me, however, to project the cost of a complete improvement program on every acre of land in a given community and then lay the figure of total costs alongside bank deposit totals for the same community. In most agricultural areas the local supply of capital is more than sufficient to meet the cost of farm improvements if they were to start now and proceed much more rapidly than we can ever hope will be the case. You will find in almost every instance that bank deposits, and in many cases even the amount of uninvested cash on hand in banks, will exceed the amount of new capital that would be required to complete a sound land use program on every acre of farmed land in the community.

Now it is true, of course, that while the total supply of capital within a community may be sufficient, there will be individual instances where the farmer lacks sufficient liquid reserves to meet the need in his particular case. He may have to resort to borrowing to carry out a sound soil improvement

program. I am convinced that a well-planned soil improvement program carried out under the right kind of supervision is a sufficiently profitable venture to justify the ready extension of credit for its completion. Farm improvement plans can be developed and financed on a basis that will enable the farmer to repay the borrowed money from income earned directly by the improvement investments. It requires a little different type of loan than the conventional real estate loan or the crop production loan with which we have long been familiar. Lending money for farm improvement programs requires a careful analysis of the individual farm and a flexible extension of credit wherein money can be advanced in varying amounts on farm real estate mortgage security over a period of years. The repayment program needs to be geared to the income pattern of the farm, varied in amount repaid from year to year as income from the improvement investments develops.

This ordinarily will mean a farm mortgage loan on which several disbursements will be made each year for a number of years and on which repayments may be very small during the early year or two of the program but will increase as the income from the farm improvement investments develops. The outstanding balance of the loan may actually increase during the first few years of the improvement program. In the farms we have studied, we have yet to find a case where money could not have been advanced to meet the costs of the conservation program as they arose, and be repaid entirely by the increased income from the improvements with plenty of margin to spare. Soil improvements, given only a little time, pay their own way, and more, without dipping into the income that would have been produced on the farm without the soil building program. I know of no other type farm mortgage credit that is so obviously self-liquidating as a loan for soil improvement.

Multiply the single farm by hundreds for the community, tens of thousands for the State, and millions for the Nation, and what do we get? Vastly increased returns, reduced costs of production, and larger profits even at the lower price levels we shall one day see. In the aggregate, a land that is at long last adjusting itself to eternal fruitfulness.

Every man must look out on the world from where he stands, so I have told you this little story about the Eighth District, though it is not different from many that others may tell. The Federal Reserve Bank of Cleveland held soil meetings of this sort in Ohio before we did. The American Bankers Association has adopted under the direction of its president C. W. Bailey of Tennessee, a great conservationist as well as a great country banker, an aggressive conservation and land use program. In my part of the country the State bankers associations of Illinois, Missouri, and Kentucky have made conservation farming their country bank program this year. Other business groups are aware of the issues and are ready to help. And in a Nation where less than a fifth of the population actually lives and works on the farms, intelligent and informed support by non-farm groups is essential if we are to develop and keep a constructive agricultural policy.

During the period of World War II, we have seen miracles of production by American agriculture. Food and fiber grown on our farms sustained our armed forces and that of our Allies and helped keep civilian lives going in friendly lands aboard. With only 15 percent of the Nation's labor force in their ranks, the farmers of the United States brought food production 30 percent above the prewar level and held it there. The food production on the farms of the United States last year averted mass starvation that threatened many millions of the earth's population.

During the early years of this vast increase in farm output, I think many observers regarded it simply as a phenomenon of war, the result of long hours and hard work on the part of farm people to produce more to meet the war emergency. I think, however, that Sherman Johnson's recent publication "Changes in Farming in War and Peace" tells the real story behind the increasing output of American agriculture; that the increase has resulted primarily from bringing into focus during the war-emergency the technical "know how" of farming that had been developed but not fully utilized during the interwar years. There has been much speculation about where the postwar level of farm production will ultimately settle. Many have felt that after the war had ended, it would settle back to normal with a total output from American farms somewhere around the prewar level. I think, however, that as more new farm machinery becomes available, as more commercial fertilizer and lime are produced and made available to farmers, as more and improved erosion control practices are applied, and as more of the technical "know how" is taken out to the farms through the channels of the Extension Service, the Soil Conservation Service, the Producton Marketing Administration, and some of the other educational agences in the field of agriculture, we may look forward to a continued high level of production above the prewar levels.

This all means that the years ahead will see some tremendous shifts and developments in American agriculture. Systems of farming will be more closely geared to sound land use capabilities. Increased amounts of mineral fertilizer and lime will be used. Many miles of terraces, drainage ditches, and other water control devices will be constructed. Fences will be reset to match the lay of the land. Much new farm machinery will be

purchased and many acres of abandoned land in some areas will be brought back into production of good pasture, small grain crops, and timber. Great number of new farm buildings will be constructed and many others completely renovated. All these developments will require capital and in the aggregate, they spell the need for a tremendous volume of new capital on American farms.

We are dealing here with a subject as broad and as deep as human life itself. It is impossible for me even to touch on all its facets in one compressed treatment. Scarcely a word has been said on the highly important subject of timber. In my part of the country men no longer say reforestation and tree cropping is not a field for private investment. Individuals and corporations are demonstrating that high yield and safety both can be found in intelligently managed pine and hard wood timber lands. Nothing has been said about the fundamental importance of this program of land and water management to wildlife, fish and game. And up to now, I've talked a lot with scarcely a look at what needs to be done, and how to go about it, to get the individual farm operator on the farms that need it, to plan now, and then to carry out next year and the next and the next, complete and balance soil improvement plans.

We have made a great deal of progress. The rate is not fast enough. On balance, we are still losing ground. I believe the American public is soil conservation conscious; that business, civic, and financial interests and organizations will support an intelligent program to get conservation plans made and performance started on farms where it is most needed. I think we all see that the goal is worth while. I wish I had a blueprint to leave with you that would chart the way to its attainment.

Leadership, it seems to me, will have to come from agriculture—the Department, the State Colleges, and the farm and cooperative organizations. I wish we might have closer teamwork there. * * *

I have tried to bring out in this talk the importance of a carefully worked out conservation plan for the individual farm, with a definite time schedule to follow. While there are plenty of cases where this has been done, I have the impression that it is not receiving the attention it warrants. The agricultural conservation payments should be used as a powerful leverage to bring about concerted farm planning. Perhaps that is the way they have been administered, but I do not get that impression in the field, where you see a farm pond here, a strip of terracing there, a grassed waterway somewhere else, but not tied together as far as eye can see in an orderly, integrated whole.

We need to develop, and soon, a well-considered, open-and-above-board policy for the orderly development and the economical use of our great mineral fertilizer resources. If they are applied in an orderly, balanced program, we should be putting on the land infinitely larger quantities of lime, phosphate, potash, and of the lesser known minerals of which smaller quantities are needed, but which are tremendously important to plant, animal, and human health. I am inclined to believe that the Department of Agriculture has the responsibility for leadership in developing such a program. * * *

I think, too, that we are on the threshold of important discoveries bearing on the relationship between soil health and human health and happiness. * * * There is no time to develop this here, but again, the Department of Agriculture, with its enormous equipment for research, and its great power to direct research, has a primary responsibility.

Some of my old friends are likely to arise and remind me that I have been talking of policies that will increase the production of our farm plant at a time when we must look soberly toward a falling off of wartime demands for many products of the farm. I am not forgetting nor minimizing the great and difficult adjustments agriculture will need to make when the war-born vacuums have been filled. The foreign demand which we have tried to meet, will not continue very long. Restoration of war-damaged farms has A–1 priority. Abroad, too, farm imports will be sought from countries which will accept payment in the form of manufactured goods. We can look forward to the time when we will not need billion bushel wheat crops for human food, and when our cotton crop will have to find its level along with synthetic fibers and foreign growths. On the other hand, milk, meat and other dairy and livestock products, tobacco, poultry, fresh vegetables and fruit will have a sustained and expanding market here at home if employment and wages and non-agricultural production keep high. . . .

Recently I have spent a great deal of time driving over Missouri, Southern Illinois, Western Kentucky, Tennessee, and other parts of the Eighth Federal Reserve District. I saw the enormous waste and destruction caused by row-cropping the hills and slopes. Hundreds of thousands of hills and slopes in this country ought to be in permanent pasture or legume and small grain rotation instead of growing sorry crops of cotton and corn. * * *

I could talk to you all night about the amazing opportunities all around us to build safer and more profitable farms on the ruins of the old ones simply by using the land right. Soil conservation and the kind of farming that goes with it are not only right morally—they pay big dividends in dollars and cents. We can use a lot of the capital and the labor we have in every community to put complete soil-and-water-use programs in effect on individual farms. We have the capital, the tools, the "know how," the minerals, and the seeds and plants with which to work a farming revolution here. The only thing that stands in the way is human inertia—human behavior again.

Now in conclusion: Along with some of you, I've gone the full cycle from the last war to this watching the evolution of farm policy aimed to provide remedies for farm problems as they unfolded. I am not afraid of the new or the untried, or of government action. But I know there is no magic. There is no substitute for efficient production, which can be secured by the intelligent use of plenty of capital per man in the form of land, tools, buildings, lime and fertilizers, and livestock. Nothing can take the place of good management of our soil and water resources.

It will be better to seek high returns per worker through large-volume, low-cost production, than to try to get the same high return by means of high prices for scarce, limited production. But the rest of the economy must play the game under the same set of rules. * * *

Benefits From Farm Woodland Management

By John W. Keller

FARM woodland management is a new phase of the American farm business, in comparison with management of cultivated fields, pastures, meadows, and livestock. Many of our farmers are only now learning that it is an important part of the farm economy. Many of them have let their woodlands deteriorate. They haven't carried out conservation practices, and their woodlands have produced less each year.

Farm woodlands that are carefully and intelligently managed are bringing in returns to the farmer frequently as high as those from cultivated fields, pastures, meadows, and orchards. The "farm forestry forty" managed by the Southern Forest Experiment Station at Crossett, Ark., is similar to many farm woodlands of second-growth loblolly and shortleaf pine. Each year, products that should be harvested are removed, on all parts of this forty. In 1945, after 7 years of planned management, the forty returned a dividend of $15.09 per acre. On experimental areas of the Alabama Agricultural Experiment Station at Auburn, Ala., planted southern pines have yielded wood products of the following value per acre per year: Slash pine 12 years old, $14; slash pine 17 years ago, $12; loblolly pine 20 years old, $20. These returns compare favorably with those from growing beef cattle. Gross returns from beef cattle production in Alabama in 1943–45 ranged from $10.50 to $20 per acre per year. One large land owner in southern Georgia stated recently that the profits from his wooded area more than made up for losses on his cultivated lands. In Region III (Indiana, Iowa, Michigan, Minnesota, and Ohio), net returns per acre per year from farm woodlands under management for 6 years or less averaged $8.50 for one group of 25 woodlands and $1.92 for another group of 39. (Ref.: Stanley S. Locke in the Journal of Forestry, Vol. 43, No. 10, "Income from Farm Woodlands.")

It is the business of Soil Conservation Service farm planners to plan proper land use for the entire farm. They must show the farmer how to get the highest returns from all parts of his farm, including the woodland. It is not always easy to convince a farmer of the actual value of farm woodlands. In advising farmers who have never been interested in their woodlands and have made no attempt to manage them conservatively, the planner needs facts and arguments supported by figures, if possible from farmer experience in the locality that will prove the value of woodlands in the farm economy.

If the farm planner makes a real effort, he will find about as many arguments to prove the importance of farm woodlands as there are to prove the importance of cultivated fields, pastures, or meadows. The principal arguments include these facts about farm woodlands:

(1) *They furnish wood for use on the farm.*—The average farm in the United States requires about 1,000 board feet of lumber, 150 fence posts, and 10 cords of fuel wood annually. At average current prices, these products are worth over $200, which the farmer would have to pay if he bought them. But the farmer doesn't buy these wood products. He cuts them in the farm woodland with farm labor, in the winter, when farm labor is not busy with other farm jobs. The woodland saves the farmer $200 annually.

(2) *They furnish revenue for farm operating expenses.*—When cutting wood for use on the farm, it is not hard to cut a few extra trees that are mature or should be removed to let more productive trees grow. This surplus of wood products usually finds ready sale locally. A little extra work in the farm woodland will not only improve the woodland but also net a few hundred dollars to increase the farm receipts.

(3) *They furnish employment for labor during the winter.*—Year-round farm labor should be gainfully employed during the winter when many of the planting, tending, and harvesting jobs for the usual farm employees are over. Farm woodland work during the winter completes the seasonal labor chart, filling in until the spring activities of the farm begin. Woods work pays a higher rate per hour than many other types of farm work, where a normal growing stock of trees is present.

(4) *They furnish various other benefits.*—Farm woodlands furnish protection, food, and nesting places for insectivorous birds and other wildlife. They afford recreation for the farm family. They retain needed soil moisture. Also, they temper the hot drying winds of summer and the strong, cold blasts of winter.

NOTE.—The author is Assistant Chief, Forestry Division, Soil Conservation Service, Washington, D. C.

REVIEWS

ELEMENTS OF SOIL CONSERVATION. By Hugh Hammond Bennett, McGraw-Hill Book Company, Inc., 1947. Pp. 406, figs. 114, graphs 14, Price $3.20

Centered on the cover of this book is a small but very impressive design of a modest moldboard plow. This innocent-looking implement, together with the axe, "stripped nature's protective cover from the ground . . . and laid bare great areas of rich soil to the forces of erosion. . . . The damage was not done maliciously but simply without thought of the consequences." The primary purpose of the author is to point up these "consequences" and to suggest the means by which erosion forces can be stopped in their tracks.

The scope of the book is lucidly presented in the chapter titles: the erosion problem in the United States, extent of erosion, effects of erosion, how erosion takes place, rates of erosion and run-off, climate and erosion, rainfall peneration, national program of soil conservation, planning for conservation of soil and water, use of vegetation in soil and water conservation, contouring, terracing, channels and outlets, gully control, control of erosion on stream banks, water spreading, wildlife and soil conservation, small dams for water storage, stubble-mulch farming, farm drainage, farm irrigation, and the place of trees and shrubs in soil and water conservation.

Bennett is an evangelist. In his enthusiasm for the cause he is inclined toward the use of highly impressive figures of the type that cannot be verified. He states that 50 million acres of cropland has already been ruined by erosion and that, for all types of land, this figure can be set at 282 million acres. He estimates the annual monetary cost of erosion to farmers at 400 million dollars and to the nation as a whole at 844 million dollars. He sets a value of 3 billion dollars on the annual loss of plant food constituents, depletion of fish in streams, and damage to the oyster industry. He says that "more than 3 billion tons of solid material are washed out of the fields and pastures of America every year, enough to load a freight train that would encircle the earth 18 times at the equator."

But when one examines the more dependable experimental data that are presented and studies the many very revealing photographs of actual damage from erosion he wonders whether Bennett's figures are not too modest an estimate of the price we have been paying. Certainly it is much more logical to say that soil is an "irreplaceable resource" and that "once it leaves a field it is as irretrievably lost as if consumed by fire" than to say that "the soil is the one indestructible, immutable asset that the nation possesses," as did Milton Whitney, Bennett's boss, 40 years ago.

In contrast to the 968-page "Soil Conservation" by the same author, which every loyal soil conservationist promised himself to read but somehow never did, this is a very readable book. It begins by telling the alarming tale about the evils of soil erosion. Then it takes the tack that "there is no longer any question as to whether or not the nation can cope with them," and outlines the proven means of keeping soil in place and water under control. The first step is planned use for the eight classes of land that are differentiated. The starting point in soil and water control is set down as some type of vegetation and this becomes a permanent cover of grassland or forest as the problem becomes more difficult of solution. Time is found to consider the place of wildlife in such a program.

The level of presentation is that of the high school, but the book will form the basis for the first course in conservation in many agricultural colleges. Each chapter begins with an enumeration of the topics to be considered and ends with a set of questions. A list of visual aids for each chapter is appended at the end of the book. The illustrations are uniformly excellent and could never have been collected except for the highly effective aid of the field forces of the Soil Conservation Service. Where photographs fail to meet the need, well-prepared graphs take their place. The book is destined for a very wide reading, not only by high-school and college students but by the public at large, and deservedly so.

FIRMAN E. BEAR.

PINEAPPLES ON THE CONTOUR

(*Continued from page 206*)

Our business is pineapples, and we expect to continue in it for a long time to come. To that end, we are committed to the policy of bequeathing to our successors a heritage of unimpaired soil resources. We believe that some worth-while progress has been made to date, but the greater challenge lies ahead.

VOICE OF MOHAWK VALLEY

(*Continued from page 203*)

blaster, checked for all clear, and plunged down the handle. The ensuing blast rumbled among the hillsides, and was caught on the wire recorder.

Then followed a description of the newly opened ditch. It was pointed out that the opening of that ditch, 7 feet wide at the top, 2 feet wide at the bottom, and nearly 5 feet deep, was accomplished for nearly a half mile in 1 day by two men—at a cost to the farmer, of only 12 to 15 cents per foot. The wire-recording was broadcast on a regular Thursday morning SCS period.

Problems vary with the country. Individual radio farm directors must work out their own methods. But effective assistance to soil conservation districts by smaller radio stations is definitely possible, and from the standpoint of all concerned it holds great promise.

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COMPILED BY WILLIAM L. ROBEY

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